

City of Glidden



108 Idaho Street

P.O. Box 349

Glidden, Iowa 51443-0349

*Phone (712) 659-3010 *** Fax (712) 659-3085*

Email g.cityhall@mchsi.com

The City of Glidden has used a variety of documents to determine cost estimates. This includes the attached preliminary study. It also includes a recent cost estimate on the same project based upon different phases from the original study.

Preliminary Drainage Study for West Glidden

City of Glidden

Glidden, Iowa
March 2008



1601 Golden Aspen Drive, Suite 103
Ames, Iowa 50010

Phone: 515-233-0000/800-433-3469 Fax: 515-233-0103
Web: www.foxeng.com E-Mail: info@foxeng.com

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**Preliminary Drainage Study for West Glidden
March 2008
City of Glidden, Iowa**

Introduction

The City of Glidden has had continued drainage problems on the west side of the City from approximately Colorado Street west to City Limits. In 1995, the City constructed an additional storm water management facility north of US Hwy 30 in order to help alleviate the drainage problems. The facility has been in operation for approximately 15 years and the City continues to have storm water flow issues, at a reduced rate, through West Glidden. The City anticipates that the drainage issues arise from outfalls of storm water from the County and City properties north of Highway 30. The City has hired FOX Engineering to evaluate the existing conditions within this area as well as the evaluate options for providing relief of storm water flows through west Glidden.

Purpose

The purpose of this report is to prepare alternate preliminary designs and cost opinions for providing storm water drainage relief for west Glidden.

Existing Conditions

The project limits are from approximately Colorado Street west to the City Limits and 4th Street North to the storm water facilities. The existing storm water ponds have a combined drainage area of approximately 114 acres. Figure A shows the approximate boundaries of the drainage area. The terrain through the project area is relatively flat with some depressed areas that collect rainfall within City limits. The City is at approximately the upper portion of the drainage area and storm water must pass through the City from the upstream farmland.

An existing 16-inch drainage district tile extends from approximately 4th Street north between Arizona Street and Colorado Street across US Hwy 30 and through the existing west storm water facility. The tile passes to the west pond within the southern quadrant of the pond as a 12-inch tile. The existing ponds outfall to the existing drain tile with overflow routing under US Hwy 30 and through the project area. The origins of the tile, the original date of installation, and the current condition of the tile are unknown. The approximate location of the existing tile is shown on Figure A1 in Appendix A. The existing tile provides drainage for West Glidden in the form of inlets. The drainage district boundary map 29 indicates that the drainage area for this district is 1137 acres, of which approximately 266 acres affects the City of Glidden.

There is 10-15 feet of fall in the drain tile pipe from the pond outfall to the edge of City limits where the tile leaves the area. The length of this section is

approximately 4000 feet. That equates to approximately 0.25 percent slope on the existing drain tile. Assuming an average drain tile size of 14-inch, the maximum capacity of the existing drain tile is approximately 2.69 cfs. Based on preliminary calculations, approximately 14 cfs and 23 cfs of storm water outfalls from the west Glidden area respectively for a 10-year and a 100-year storm event. Therefore, the existing district drain tile does not have adequate capacity to remove the water from the west Glidden area during a heavy rain event. This causes surface water to accumulate in the project area and cause drainage problems and localized flooding.

The existing ponds north of US Hwy. 30 were constructed at different times. The original design and construction dates of the east pond are unknown and design information for the east pond is not currently available. The design of the west pond was completed by MER Engineering in February of 1995 in order to provide additional storm water flow relief through the City of Glidden by providing additional storage upstream. The west pond was constructed soon thereafter and is shown on Figure 1.

Based on assumptions for size and depth, the existing east pond displays the ability to contain the 100-year storm event without overtopping the existing embankment.



Figure 1. Existing West Pond

As discussed, overflow from the pond outfalls are routed under US Hwy 30 and then through a series of drainage channels and residential neighborhoods before being released to the neighboring farmers field just west of the City limits. The flows enter the city through a pipe under US Hwy 30 as shown on Figure 2.

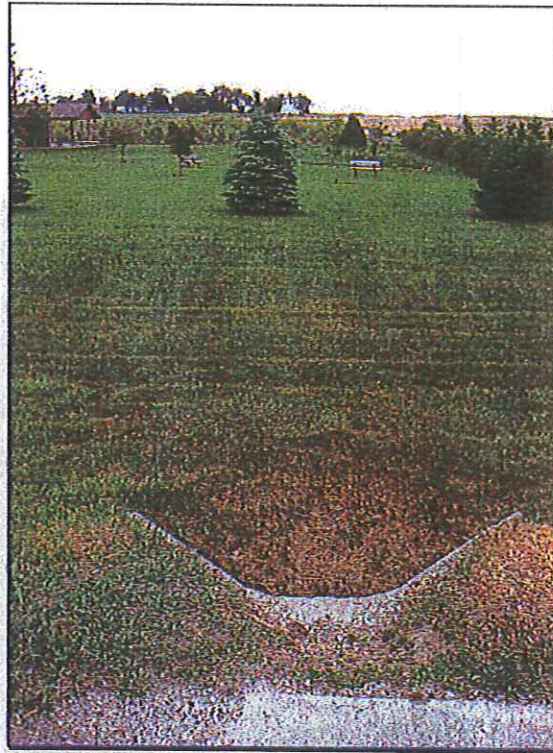


Figure 2. Culvert Under US Hwy 30

Flows from under US Hwy 30 then continue through a channel along US Hwy 30 to a culvert at the intersection of Montana and 7th street where an inlet collects flows and releases it just beyond the church property in a drainage channel between Montana and Dakota.



Figure 3. Channel Along US Hwy 30



Figure 4. Inlet at 7th Street

The drainage channel continues south where it crosses 6th Street through two 12-inch culverts as shown in Figure 5.



Figure 5. Culvert Inlets at 6th Street



Figure 6. Culvert Outlets at 6th Street

Flow then continues through residential back yards and streets. The flow enters the district drainage tile at 5th Street and Dakota.

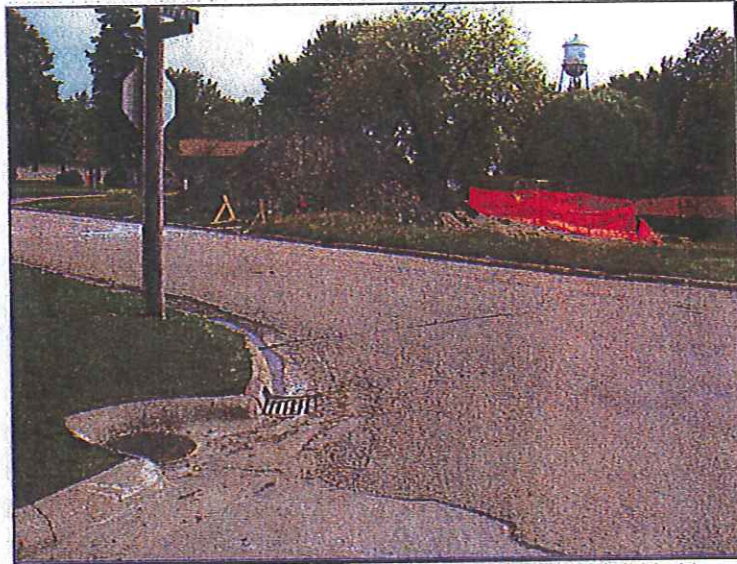


Figure 6. Tile Inlets at 5th St. and Dakota

Design Storm

The design storm entering the ponds was determined based on information currently available in the form of aerial photos and USGS quad maps. The design information for the west pond was used to determine pond geometry and outlet configuration. The east pond was assumed to contain approximately four feet of depth based on the size and location available on aerial photography. Calculations were then completed for the flows entering the pond for variable storm recurrence intervals.

The peak discharge rate was determined by using SCS runoff method. The curve number for the drainage areas entering the pond was determined to be 81. The time of concentration is approximately 60 to 70 minutes. The rainfall intensity for a 10 year, 60 minute storm is 2.02 inches (per hour). The area of drainage is approximately 94 and 29 acres respectively for the west and east ponds. Using the SCS method, the 10-year inflow rate into the ponds was calculated to be approximately 126 and 35 cubic feet per second (cfs) respectively for the west and east ponds.

The rainfall intensity for a 100-year event for a 60-minute storm is 3.29 inches per hour. Using the SCS method, the 100-year inflow rate into the ponds was calculated to be approximately 255 and 70 cfs respectively for the west and east ponds.

Discussion of Project Options

There are 4 options that have been evaluated for effectiveness and cost. All designs are based on a 10-year event. In addition, all options are expected to pass the 100-year event with minimal impact to the adjoining street and properties.

The options are broken into two types. The first provides additional storm water storage volume upstream of the City of Glidden at the existing ponds. The second provides for collection and routing of storm water flows through the city.

Option No. 1 – West Pond Berm Construction

Currently, the existing west pond has an opening in the berm for a foot-bridge on the southwest corner of the pond. According to the design drawings completed by MER Engineering, the elevation at which the water leaves the pond through this opening is at an elevation of 103 feet as shown in Figure B1. Initial pond routing calculations indicate that the water surface elevation for the 25-year storm exceeds this elevation and allows water to flow out of the pond and along the south side of the existing pond berm and then to the culvert under US Hwy 30. It is anticipated that approximately 21 cfs of additional outflow leaves the pond during the 100-year storm event, or after 3.29 inches of rain in one hour. Extending the berms approximately 130 lf and matching the existing pond berm top elevation of 105 feet allows for capture of this additional storm water runoff without allowing discharge to the already stressed drainage system down stream in west Glidden.



Figure 9. Existing West Pond Berm Extension Location.

We estimate that approximately 10 acres of farmland could be affected at maximum pond level. The use of farmland for detention could be handled in several ways:

1. Outright purchase of the effected property. The City could cash rent the property to the adjoining landowners. When the ground was flooding the City may or may not receive any rent depending on the agreement reached with the farmer/landowner.
2. Purchase of an easement to allow for periodic flooding. The problem with determining the value of the easement is that the degree and frequency of flooding is unknown.
3. Purchase a conditional easement. The landowner would be paid some value initially and then paid for every occurrence of flooding based on the area flooding and the amount of damage. Since most of the land floods relatively frequently already this would in essence pay the farmer flood insurance. It might be possible the initial crop would be flooded out and a second planted successfully – these scenarios would need to be addressed.

For this option we considered that the land would be farmed and not converted to permanent vegetation. The farming operation would eliminate any maintenance, mowing, etc. However, if the area was permanently seeded, the performance of the system would be increased (due to less runoff) and the area could be left relatively dry.

Option No. 2 – West Pond Excavation

This option is very similar to Option No. 1 in that it allows for additional storm water runoff volume in the existing west pond. However, the additional volume is obtained by excavation of soil material from within the existing interior pond footprint rather than taking advantage of the existing topography and constructing a berm. It is anticipated that approximately 16,000 cubic yards of material would be removed for this option based on the proposed contours shown in Figure B2 in Appendix B. It is anticipated that the spoils from earthwork activities will be available as fill material for another project in the area or can be placed in the east pond area north of the existing pond temporarily until the material can be used or sold. Proposed grades for the Pond excavation are preliminary. Detailed grading information for the ponds will be included in the final design phase for the project.

Based on preliminary calculations, the outflow is reduced during the 100-year storm event, or after 3.29 inches of rain in one hour, to approximately 7 cfs.

Option No. 3 – Storm Sewer

In order to provide relief downstream of the existing ponds, a storm sewer system may be installed. Based on preliminary computations for a 100-year storm event, or 3.29 inches of rain per hour, this storm sewer system would be primarily a 30-inch and 36-inch line that would capture storm water flows under US Hwy 30 and route it through town. This option is anticipated to pass the following flows from upstream and within the project limits:

Storm Event (Yr)	Outfall from Ponds (cfs)	Upstream Flow (cfs)	Flow from West Glidden (cfs)
10	0.5	18	14
100	20	30	23

The storm sewer would then outfall near the existing water tower west of town and discharge into the neighboring farmers fields until the existing drainage district tile can remove the surface water over time. An outfall structure would be designed to allow the storm water flows to discharge to the surface and then surface flow away from town limits. Arrangements with the landowner would likely need to be made for this option similar to option 1. Detailed storm sewer information and analysis for the project would be included in the final design phase. The location of the storm sewer route is shown on Figure B4 in Appendix B.

Option No. 4 – Drainage Improvements and Storm Sewer

Drainage improvements within secondary flow path for the project area may provide for relief of storm flows during rain events. The secondary flow path is the path of storm water flow over the surface when subsurface and surface drainage paths capacities are exhausted. Improvements may include installation of drainage channels and culverts, as well as localized grading to reduce ponding and promote drainage. As part of this option, a defined channel would be constructed in order to pass flows in a defined area. The existing culverts within the existing drainage paths would be upsized to allow additional flows to pass as well. Additionally, a section of storm sewer line would be extended into West Glidden in order to collect channel flows and surface drainage. This section of storm sewer would outfall similar to Option 3. Figure B3 in Appendix B indicates areas that have been targeted for possible drainage improvements.

Opinions of Probable Cost for Each Option

A cost opinion for each option, based on the preliminary design provided for each option, is included in Appendix C. A summary of the option costs are provided as follows:

Each estimate includes a 15% project contingency. The estimates are based limited information and therefore may, or may not, be

representative of actual construction costs. However, rehabilitation projects are inherently more risky and there will be unforeseen complications as work proceeds. For a rehabilitation project we recommend the Owner maintain a 15% contingency fund throughout the project to cover unexpected construction difficulties.

The most economical option is Option 1 where the pond berms are extended to allow for additional pond volume. The anticipated cost for this option is approximately \$115,130. However, this option does not account for the flows bypassing the ponds and entering the City of Glidden.

The second most economical option is Option No. 2 that excavates within the footprint of the existing west pond. This option is very similar to Option No. 1 and is more expensive (\$148,700). Like option 1, this option does not account for storm water not going into the ponds.

Option No. 3 is the next expensive option that does collect water the flows directed into the City of Glidden. This option is the most expensive at \$512,325 and is primarily due to the cost of installing the large size line required to carry the 100-year storm event as well as disturbance and repair of existing surface features and utilities.

Option No. 4 has a cost between the pond improvement options (options 1 and 2) and the storm sewer option 3. This option has a cost of approximately \$320,400 and does collect water flows directed into the City of Glidden as well as collects flows within West Glidden.

Recommendations

Our recommendation is to proceed with, at a minimum, Option No. 1. Additionally, the City may consider additional storm water drainage relief by proceeding with option 4, additional drainage improvements, in the future. We do not recommend option #3 due to the cost that is included with installing this length of line.

Additional Considerations

We considered some other options that were not considered feasible. The first would be to construct an additional pond below the existing west pond. It was determined that the additional volume and the storm water flows captured would not be cost effective. The second was to pipe the flows entering under US Hwy 30 west south along Arizona and west to the west City Limits along 6th Street. The pipe would outfall with an outfall structure similar to option 3. This was determined to not be effective because of the depth of storm sewer installation as well as not contributing to the drainage in a majority of the project area in West Glidden. The third was to evaluate the east pond to determine if the west and east

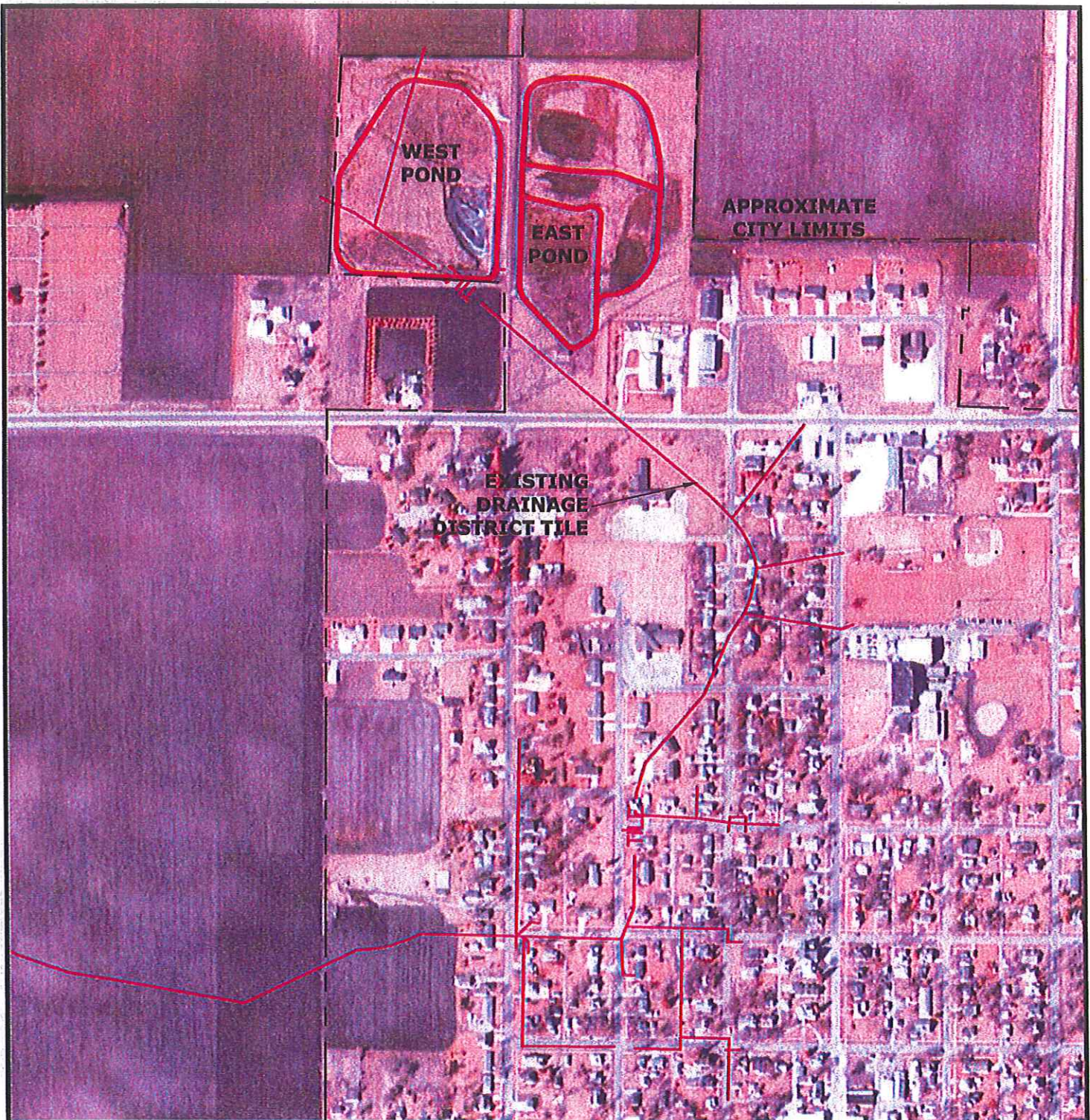
ponds could be linked together to provide additional storm water volume storage. Based on elevations and the existing geometry of the west and east pond, it was determined that this would be difficult to accomplish with only a small improvement. Additionally, the existing drainage district tile was considered for improvement. However, upsizing of this line would require replacement of approximately 2.3 miles of drainage district tile to the outfall in order for this to be effective. This was not considered feasible for this project.

Summary

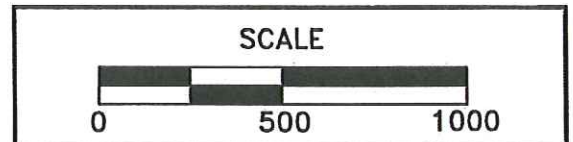
Storm water drainage through the existing West Glidden area is affected by many different factors. Of these factors is the existing drainage district tile that extends through the City. The flow volume generated by the drainage area is significant for the size of line currently available. Therefore, drainage in the west Glidden area is currently affected not only by the existing ponds upstream, but by the drainage district tile itself. It is anticipated that improvements to the pond upstream will produce improvements to the drainage in the West Glidden area. However, it is anticipated that not all of the drainage issues within the West Glidden area will be mitigated by pond improvements and additional drainage improvements within the West Glidden area will likely be necessary.

APPENDIX A

OVERVIEW AND POND DRAINAGE AREA MAP



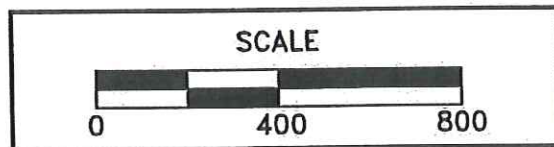
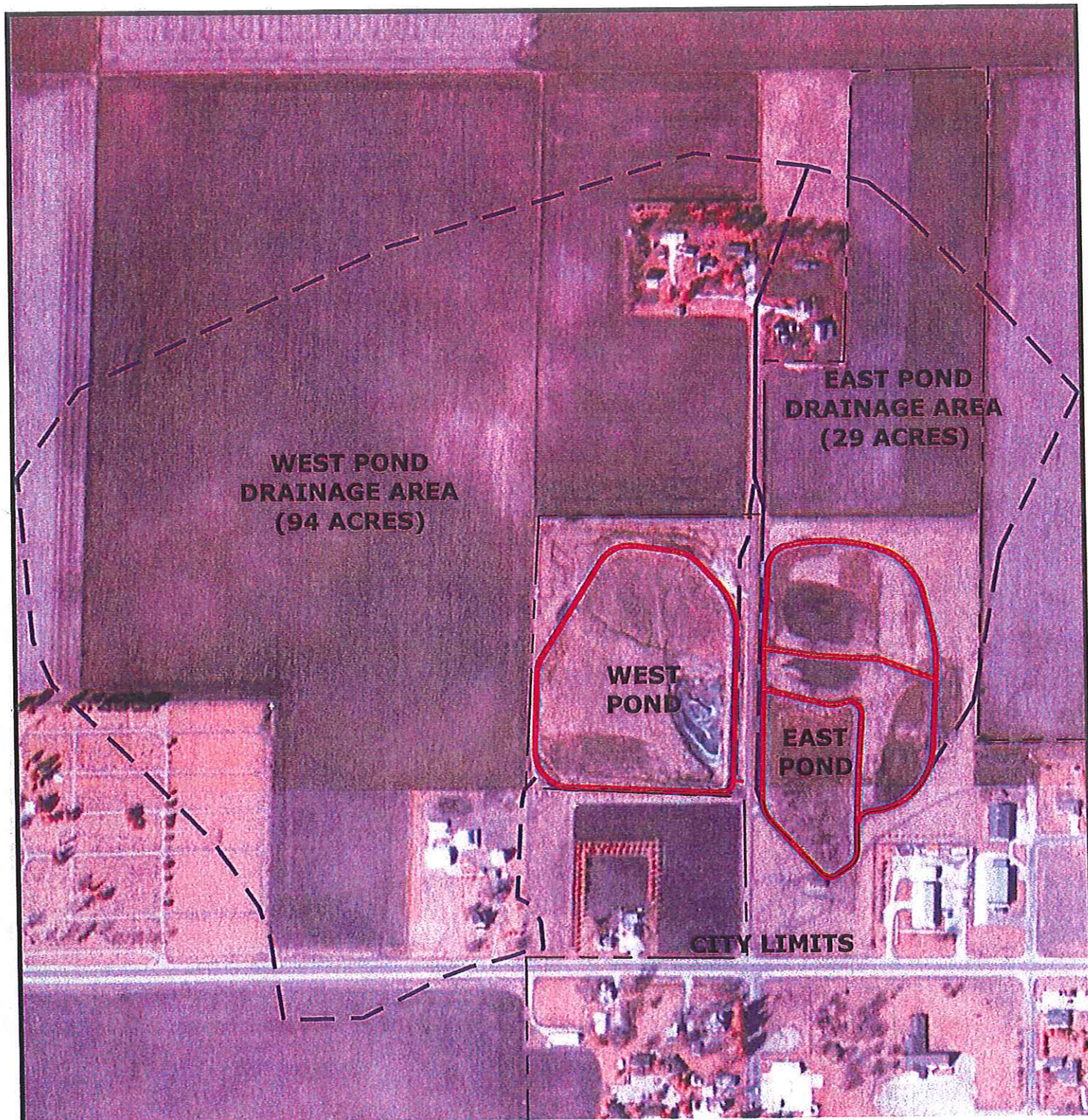
NOTE:
 LOCATION OF EXISTING TILE
 OBTAINED FROM AVAILABLE
 INFORMATION AND SHOULD BE
 FIELD VERIFIED.



OVERVIEW MAP

FIGURE: A1

REVISION	NO.	DATE
DRAWN SPS	PROJECT NO. 7081-07A	DATE 3/20/08



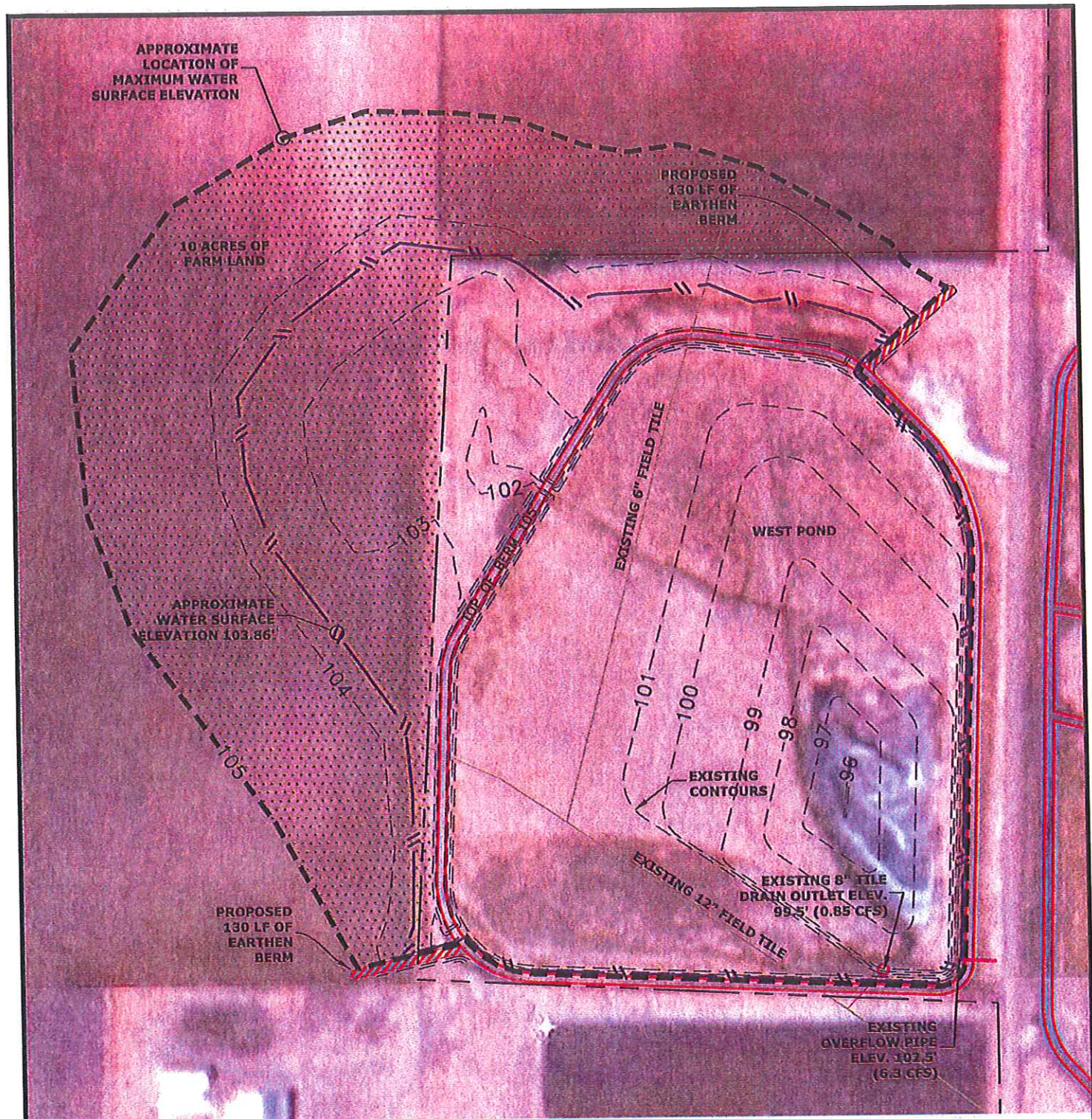
DRAINAGE AREA MAP

FIGURE: A2

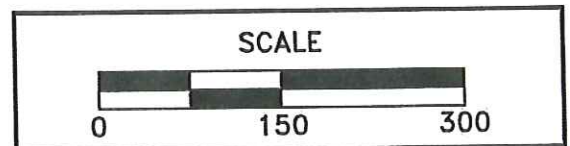
REVISION	NO.	DATE
DRAWN SPS	PROJECT NO. 7081-07A	DATE 3/03/08

APPENDIX B

PRELIMINARY OPTION PLANS



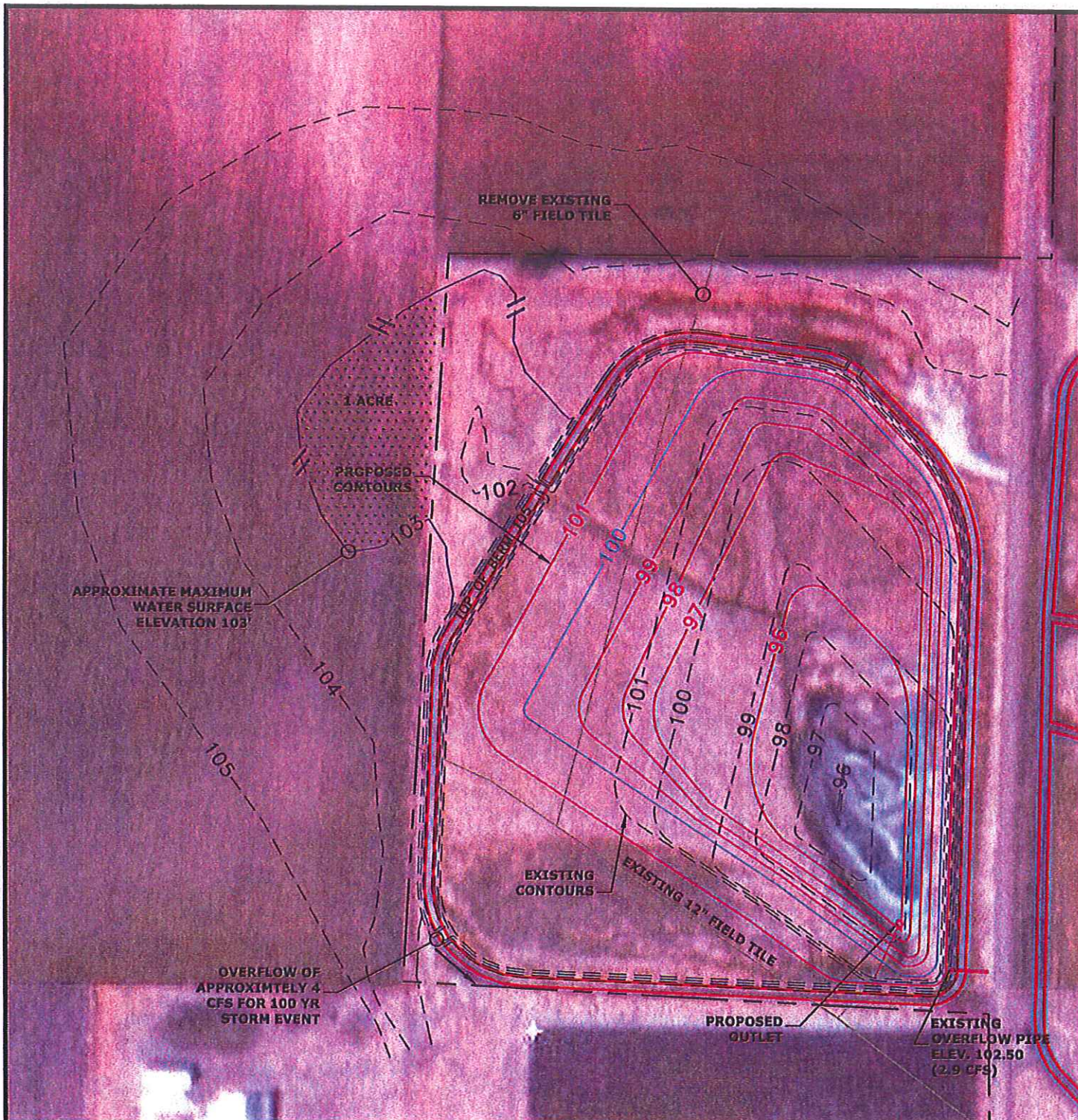
NOTE:
LOCATION OF EXISTING TILE
OBTAINED FROM AVAILABLE
INFORMATION AND SHOULD BE
FIELD VERIFIED.



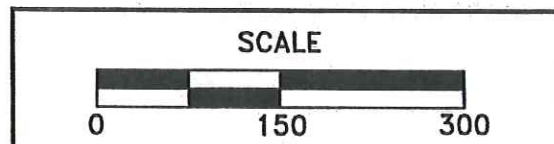
**OPTION 1 - WEST POND BERM
EXTENSION**

FIGURE: B1

REVISION	NO.	DATE
DRAWN SPS	PROJECT NO. 7081-07A	DATE 3/03/08



NOTE:
LOCATION OF EXISTING TILE
OBTAINED FROM AVAILABLE
INFORMATION AND SHOULD BE
FIELD VERIFIED.



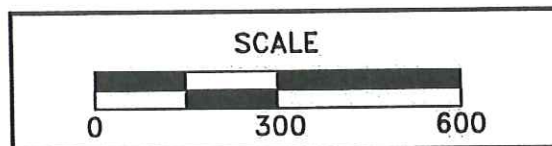
**OPTION 2 - WEST POND
EXCAVATION**

FIGURE: B2

REVISION	NO.	DATE
DRAWN SPS	PROJECT NO. 7081-07A	DATE 3/03/08



NOTE:
LOCATION OF EXISTING TILE
OBTAINED FROM AVAILABLE
INFORMATION AND SHOULD BE
FIELD VERIFIED.



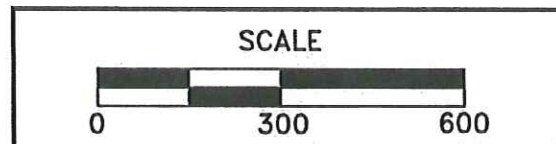
OPTION 3 - STORM SEWER

FIGURE: B3

REVISION	NO.	DATE
DRAWN SPS	PROJECT NO. 7081-07A	DATE 3/03/08



NOTE:
 LOCATION OF EXISTING TILE
 OBTAINED FROM AVAILABLE
 INFORMATION AND SHOULD BE
 FIELD VERIFIED.



**OPTION 4 - DRAINAGE
 IMPROVEMENTS**

FIGURE: B4

REVISION	NO.	DATE
DRAWN SPS	PROJECT NO. 7081-07A	DATE 3/20/08

APPENDIX C

OPINION OF PROBABLE OPTION COSTS

CITY OF GLIDDEN

Storm Water Improvement Options
Opinion of Probable Construction Costs

FOX PN# 7081-07A
Schematic Phase

OPTION 1	WEST POND BERM CONSTRUCTION
OPTION 2	WEST POND EXCAVATION
OPTION 3	STORM SEWER
OPTION 4	DRAINAGE IMPROVEMENTS

Date 03/20/2008
Estimator: S.P. SOUPIR

CONSTRUCTION ITEM	OPTION 1			OPTION 2			OPTION 3			OPTION 4		
	UNIT	QTY.	ITEM COST	UNIT	QTY.	ITEM COST	UNIT	QTY.	ITEM COST	UNIT	QTY.	ITEM COST
SITE PREPARATION												
MOBILIZATION				LS	1	\$5,000.00						
CLEARING				AC	7.5	\$5,625.00						
EARTHWORK				CY	500	\$2,500.00						
EROSION CONTROL				LS	-	\$1,000.00						
EASEMENTS				LS	-	\$2,500.00						
LAND ACQUISITION				AC	10	\$60,000.00						
Site Preparation Subtotal:						\$76,625.00						
SITE WORK (Installed)												
12" RCP				LF	0	\$0.00						
30" RCP				LF	0	\$0.00						
36" RCP				LF	0	\$0.00						
POND OUTLET STRUCTURE IMPROVEMENTS				EA	1	\$3,000.00						
STORM SEWER INLETS				EA	0	\$0.00						
STORM SEWER OUTLET STRUCTURE				EA	0	\$0.00						
ASPHALT WALK REPAIR				SF	200	\$1,600.00						
GRAVEL ROAD REPAIR				SF	200	\$1,200.00						
ASPHALT ROADWAY REMOVAL AND REPAIR				SY	0	\$0.00						
Site Work Subtotal:						\$5,800.00						
LANDSCAPE												
4" TOPSOIL AND SEED				AC	1	\$1,000.00						
Landscaping Subtotal:						\$1,000.00						

SUMMARY OF COST

SITE PREPARATION	OPTION 1	OPTION 2	OPTION 3	OPTION 4
	\$76,625.00	\$92,750.00	\$31,250.00	\$45,000.00
SITE WORK (Installed)				
	\$5,800.00	\$7,000.00	\$338,000.00	\$183,170.00
LANDSCAPE				
Subtotal	\$83,425.00	\$107,750.00	\$371,250.00	\$232,170.00
Add 15% contingency	\$12,513.75	\$16,162.50	\$55,687.50	\$34,825.50
Engineering / Survey / Administration (20%)				
	\$19,187.75	\$24,782.50	\$85,387.50	\$53,399.10
TOTAL	\$115,127	\$148,695	\$512,325	\$320,395

NOTES CONCERNING THE CONSTRUCTION COST ESTIMATE:

1. The Opinion of Costs included herein are a compilation of costs based on information to date and may not reflect actual construction costs for the project.

CITY OF GLIDDEN

Storm Water Improvement Phases
Opinion of Probable Construction Costs
FOX PN# 7081-07A

PHASE 1	STORM SEWER
PHASE 2	WEST POND EXCAVATION
PHASE 3	WEST POND BERM CONSTRUCTION

Date 07/24/2009
Estimator: S.P. SOUPIR

Schematic Phase		PHASE 1			PHASE 2			PHASE 3		
CONSTRUCTION ITEM	UNIT COST	UNIT	QTY.	ITEM COST	QTY.	ITEM COST	QTY.	ITEM COST	QTY.	ITEM COST
SITE PREPARATION										
MOBILIZATION	\$5,000.00	LS	1	\$5,000.00	1	\$5,000.00	1	\$5,000.00	1	\$5,000.00
CLEARING	\$750.00	AC	1	\$750.00	3	\$2,250.00	7.5	\$5,625.00	7.5	\$5,625.00
EARTHWORK	\$5.00	CY	3000	\$15,000.00	16000	\$80,000.00	500	\$2,500.00	500	\$2,500.00
EROSION CONTROL	-	LS	-	\$2,500.00	-	\$3,500.00	-	\$1,000.00	-	\$1,000.00
EASEMENTS	-	LS	-	\$8,000.00	-	\$1,000.00	-	\$2,500.00	-	\$2,500.00
LAND ACQUISITION	\$6,000.00	AC	-	-	1	\$1,000.00	10	\$60,000.00	10	\$60,000.00
Site Preparation Subtotal:				\$31,250.00		\$92,750.00		\$76,625.00		
SITE WORK (Installed)										
12" RCP	\$40.00	LF	-	\$0.00	30	\$1,200.00	-	\$0.00	-	\$0.00
30" RCP	\$75.00	LF	2628	\$197,100.00	-	\$0.00	-	\$0.00	-	\$0.00
36" RCP	\$100.00	LF	489	\$48,900.00	-	\$0.00	-	\$0.00	-	\$0.00
POND OUTLET STRUCTURE IMPROVEMENTS	\$3,000.00	EA	-	\$0.00	1	\$3,000.00	1	\$3,000.00	1	\$3,000.00
STORM SEWER INLETS	\$3,000.00	EA	12	\$36,000.00	-	\$0.00	-	\$0.00	-	\$0.00
STORM SEWER OUTLET STRUCTURE	\$3,500.00	EA	1	\$3,500.00	-	\$0.00	-	\$0.00	-	\$0.00
ASPHALT WALK REPAIR	\$8.00	SF	-	\$0.00	200	\$1,600.00	200	\$1,600.00	200	\$1,600.00
GRAVEL ROAD REPAIR	\$6.00	SF	-	\$0.00	200	\$1,200.00	200	\$1,200.00	200	\$1,200.00
ASPHALT ROADWAY REMOVAL AND REPAIR	\$75.00	SY	700	\$52,500.00	-	\$0.00	0	\$0.00	0	\$0.00
Site Work Subtotal:				\$338,000.00		\$7,000.00		\$5,800.00		
LANDSCAPE										
4" TOPSOIL AND SEED	\$1,000.00	AC	2	\$2,000.00	8	\$8,000.00	1	\$1,000.00	1	\$1,000.00
Landscaping Subtotal:				\$2,000.00		\$8,000.00		\$1,000.00		

SUMMARY OF COST

	PHASE 1	PHASE 2	PHASE 3
SITE PREPARATION	\$31,250.00	\$92,750.00	\$76,625.00
SITE WORK (Installed)	\$338,000.00	\$7,000.00	\$5,800.00
LANDSCAPE	\$2,000.00	\$8,000.00	\$1,000.00
Subtotal	\$371,250.00	\$107,750.00	\$83,425.00
Add 15% contingency	\$55,687.50	\$16,162.50	\$12,513.75
Engineering / Survey / Administration (20%)	\$85,387.50	\$24,782.50	\$19,187.75
TOTAL	\$512,325	\$148,695	\$115,127
TOTAL ALL PHASES	\$776,147		

NOTES CONCERNING THE CONSTRUCTION COST ESTIMATE:

- The Opinion of Costs included herein are a compilation of costs based on information to date and may not reflect actual construction costs for the project.

